

**Bruce A. Measure**  
Chair  
Montana

**Rhonda Whiting**  
Montana

**W. Bill Booth**  
Idaho

**James A. Yost**  
Idaho



**Joan M. Dukes**  
Vice-Chair  
Oregon

**Bill Bradbury**  
Oregon

**Tom Karier**  
Washington

**Phil Rockefeller**  
Washington

December 6, 2011

## MEMORANDUM

**TO:** Council Members

**FROM:** John Fazio, Senior System Analyst

**SUBJECT:** Adoption of a Revised Resource Adequacy Standard for the Northwest

At its December 6<sup>th</sup> meeting, the Council is scheduled to vote on the adoption of a proposed revision to the resource adequacy standard that it approved in 2008. The revisions are recommended by the Resource Adequacy Forum, who concluded that improvements were warranted based on its experience with implementing the 2008 standard and after a peer review of the overall methodology.

While the 2008 standard was very useful, some of the results were confusing and difficult to compare to other regionally published reports. In addition, the peer review report suggested that additional information should be provided to better aid regional resource planners. The Forum believes that the revised standard is both simpler and better than the 2008 version.

This effort is the direct result of action item ADQ-3 in the Council's 6<sup>th</sup> Power Plan, which calls for the Council to periodically review the adequacy standard and the methodology used to define the standard and to make amendments, if warranted.

Draft language for the revised standard (Council document number 2011-13) was released for public comment from October 17<sup>th</sup> through November 11<sup>th</sup>. Comments were all in support of the proposed revisions.

Attachments to this memorandum include:

- A decision memorandum
- The revised adequacy standard language (Council document 2011-14)
- A summary of comments

q:\tm\council mtgs\2011\dec11\c01\_adequacy std cm.docx

**Bruce A. Measure**  
Chair  
Montana

**Rhonda Whiting**  
Montana

**W. Bill Booth**  
Idaho

**James A. Yost**  
Idaho



**Joan M. Dukes**  
Vice-Chair  
Oregon

**Bill Bradbury**  
Oregon

**Tom Karier**  
Washington

**Phil Rockefeller**  
Washington

December 6, 2011

## **DECISION MEMORANDUM**

**TO:** Council members

**FROM:** John Fazio  
Senior Systems Analyst

**SUBJECT:** Adoption of a Revised Resource Adequacy Standard for the Northwest

### **PROPOSED ACTION:**

Adopt the Resource Adequacy Forum's proposed new adequacy standard as detailed in Council document number 2011-14, "A New Resource Adequacy Standard for the Pacific Northwest." Upon adoption, this document will supersede the previous standard adopted by the Council in 2008 (Council document 2008-07).

### **SIGNIFICANCE:**

- The adoption of this standard effectively completes action item ADQ-3 in the Council's 6<sup>th</sup> Power Plan.
- Adoption of the energy bill in 2005 gave the Federal Energy Regulatory Commission (FERC) authority to assess the adequacy of the nation's power supplies. The Western Electricity Coordinating Council (WECC) is in the process of developing a probabilistic methodology to assess adequacy for the West. The proposed standard for the Northwest and the corresponding adequacy assessments will aid in WECC's efforts.
- The Bonneville Power Administration (BPA) has been a joint sponsor of the Resource Adequacy Forum and intends to incorporate the revised standard into its own long-term planning process.
- The establishment of a regional resource adequacy standard will provide a consistent context to utilities, regulatory commissions and public utility boards in their assessment of individual utility resource plans.

### **BUDGETARY/ECONOMIC IMPACTS:**

- There are minimal effects on the Council's budget. An assessment of the adequacy of the Northwest's power supply will be made annually by Council staff, aided by members of the Forum. In addition, the methodology used to develop this standard and its targets will

be reviewed whenever it is deemed to be appropriate. At this time, there remain some details related to the hourly hydro dispatch logic that must be resolved prior to the next assessment. Some of this work will be provided by contractors. The total cost for this work should not exceed \$30,000 for this fiscal year.<sup>1</sup> There is no anticipated contract work on this issue for the next fiscal year (2013).

- The regional economic benefits of establishing a resource adequacy standard could be significant. Historically, the region has experienced periods of surplus and deficit energy supplies. Neither situation is desirable from an economic point of view. The establishment of an adequacy standard will not only help reduce the risk of unexpected curtailments and but also minimize the number of times the region finds itself in a costly situation of too little or too much energy supply.

## **BACKGROUND:**

Events such as the Western energy crisis of 2001, which led to both curtailments in California and to West-wide electricity price spikes, have forced utilities and regulators to rethink their approach to planning and operating the power system. In that year, the Northwest experienced its second-lowest water year (based on historical records since 1929). Also, few new resources were developed during the late 1990s, leading to areas of resource deficiency throughout the West. These factors, combined with a flawed electricity market design in California and apparent market manipulation, led to the undesirable events of 2001.

The crisis demonstrated that the public has little tolerance for high and volatile market prices over a prolonged period. The Council embraced this challenge and in its 5<sup>th</sup> Power Plan called for the development of a regional adequacy standard, with the intention that it provide an early warning should resource development fall dangerously short. In April of 2008, the Council adopted the Resource Adequacy Forum's proposal. Had that standard been in place during the previous decade, the alarm would have sounded in the mid-1990s, indicating that the likelihood of high prices or shortfalls was greater than the public could tolerate at that time.

## **ANALYSIS:**

The Council and Forum have had three years to evaluate the effectiveness of the 2008 standard. Overall, it has yielded significant benefits to utility planners, in that it has forced them to review their own methods and data. However, parts of the assessment have been confusing and difficult to compare to data in other regional publications. In addition, the original standard was only designed to assess winter and summer periods, ignoring potential problems in the fall and spring. Because of this (and also referencing action item ADQ-3 in the Council's 6<sup>th</sup> Power Plan) the Forum chose to have the adequacy methodology peer reviewed.

Results from the peer review along with Forum analysis and related documents are posted on the Council's web site at <http://www.nwcouncil.org/energy/resource/Default.asp>. In short, the Forum chose to adopt many of the suggestions from the peer review. The new standard keeps the probabilistic methodology but simplifies the analysis to include only one measure of adequacy for the entire year (as opposed to separate measures for winter and summer). The Forum also chose to eliminate the translation of the probabilistic assessment into more

---

<sup>1</sup> The Council has already approved the funding for the contract to resolve these issues.

commonly used static measures of loads and resources (thus eliminating the confusion when comparing to other regional reports). Although not a part of the standard, the Forum suggested adding a *State of the System* report to the assessment, which will include other commonly used adequacy metrics, statistical information about potential shortfalls and information about the likelihood and amount of market resources used.

#### **ALTERNATIVES:**

- One alternative is to not modify the current Northwest resource adequacy standard. This means that the region would continue to assess adequacy in the same way it has for the past 3 years. The outcome of this alternative is to continue to promote a period of confusion every year when the assessment is made. It could also lead to a false sense of adequacy since it does not evaluate potential problems in fall and spring.
- A second alternative is to remove the current standard and allow the WECC to establish a West-wide adequacy standard that would also apply to the Northwest. The drawback to this alternative is that WECC has little or no expertise in planning for systems that are energy-limited (as opposed to capacity-limited regions such as in California). The WECC standard would not likely address Northwest needs in an appropriate way.
- A third alternative is to simply remove the current standard, with no replacement. This would eliminate the early warning system that the standard was designed to provide. Relying solely on utility planners to design and acquire adequate supplies has not always worked well in the past.

#### **ATTACHMENTS:**

Attached is the proposed new resource adequacy standard (Council document 2011-14), a draft version of which was released for public comment from October 17<sup>th</sup> through November 11<sup>th</sup>. Also attached is a summary of comments.

q:\tm\council mtgs\2011\dec11\c01a\_new adeq std dm.docx

**Bruce A. Measure**  
Chair  
Montana

**Rhonda Whiting**  
Montana

**W. Bill Booth**  
Idaho

**James A. Yost**  
Idaho



**Joan M. Dukes**  
Vice-Chair  
Oregon

**Bill Bradbury**  
Oregon

**Tom Karier**  
Washington

**Phil Rockefeller**  
Washington

December 6, 2011

## MEMORANDUM

**TO:** Council Members

**FROM:** John Fazio, Senior System Analyst

**SUBJECT:** Summary of Comments for the Proposed New Resource Adequacy Standard

Below is a summary of comments received on the proposed changes to the Resource Adequacy Standard adopted by the Council in April of 2008. It should be noted that most, if not all, utility planners and other interested parties in the region were represented in the development of the proposed changes. Their contributions to the new standard have already been incorporated into the revised language. Thus, the number of comments received was small, which does not indicate a lack of interest for this issue. Assessing the adequacy of the power supply must be an integral part of any integrated resource planning methodology.

### **Howard Schwartz (state of Washington) on 10/13/2011:**

We should have some discussion of what the availability of California resources would be if there is a significant shift from old thermal plants to large amounts of distributed generation, especially solar.

### **Mollie Gratreak (Bonneville Power Administration) on 10/13/11:**

Mollie provided a number of editorial suggestions for the draft standard and background paper.

She agreed that having three possible conditions for the supply (green for adequate, yellow for approaching inadequacy and red for inadequate) is a good idea. She also thought that including a *State of the System* report was a good idea.

### **Puget Sound Energy on 10/14/11:**

Outstanding recommendation to simplify the standard to just an annual 5% LOLP...nothing more, no other LOLP's...no conversions to deterministic metrics. Love it!

Even though “planning reserve margins” are no longer a part of the adequacy standard, they suggest that, for future reference, they should be referred to as “planning margins” because there is no reserve in them.

They also suggested changing the acronym for the CVaR variables (in the *State of the System* report) because of the potential confusion with similar metrics used in economics.

They like the approach of defining an objective standard for “significant” events by using standby resources as the threshold. They support the idea of using a green, yellow and red light indicator for the status of the power supply. They suggest that using standby resources too often should trigger a yellow light condition.

**Snohomish County PUD on 11/11/11:**

Snohomish supports the changes proposed in the revised standard. They suggest that the Forum consider using the Expected Unserved Energy (EUE) metric for future adequacy assessments.

**Seattle City Light on 11/10/11:**

Seattle City Light supports the changes proposed in the revised standard but suggest that the number of simulations used for the analysis be more robustly determined.

They also suggest that wind data should be re-examined and correlated with temperature events.

They suggest that off-peak market purchases should be a part of the analysis.

**Public Power Council 11/11/11:**

PPC supports the Council’s proposed resource adequacy standard. They also support the function of the standard as an “early warning system” and like the idea of using the expected dispatch of standby resources as the gauge to indicate when the system is approaching inadequacy.

They encourage the Council to continue to develop better wind data, in particular, temperature-correlated synthetic data sets.

**Portland General Electric (verbal comments to John Fazio) November 2011:**

PGE supports the Council’s proposed resource adequacy standard and would like to see the continuation of the red, yellow and green light status determination for the power supply.

**State of Idaho Department of Environmental Quality 11/8/11:**

The Idaho DEQ wanted the Council to ensure that water quality issues were not compromised because of the adoption and implementation of the revised resource adequacy standard.

## **From PNGC**

PNGC supports the proposed revisions to the adequacy standard. They suggested that more analysis may be required to define the standby resources (the Forum acknowledges this and is intending to do so). They have some concern regarding the elimination of the static measures but understand the confusion they have led to. They believe that a *State of the System* report is a good idea, as long as it is concise and intuitive.

---

q:\tm\council mtgs\2011\dec11\c01b\_new adeq std comments.docx

# A New Resource Adequacy Standard for the Pacific Northwest

Council Document Number 2011-14



12/6/2011



## PURPOSE

The Northwest Power and Conservation Council has adopted the following methodology, recommended by the Resource Adequacy Forum, to assess the adequacy of the Northwest's power supply. The purpose of this assessment is to provide an early warning should resource development fail to keep pace with demand growth. The Council has also approved developing a *State of the System* report, to accompany the assessment. This report will provide additional information regarding the status of the power supply.

## RESOURCE AND LOAD ASSUMPTIONS

The Forum will evaluate the region's power supply adequacy five years into the future. Regionally owned generating resources, expected efficiency savings and some level of market resources are assumed for the assessment. Council staff will collect and maintain resource data, which also includes information on firm import and export contracts and on variable resources (such as wind). Regionally owned generating resources include existing plants and planned projects that are expected to be operational during the year being assessed. Assumptions regarding the amount of in-region and out-of-region market supplies and the use of hydroelectric system flexibility<sup>1</sup> will be made by the Forum. Load assumptions will be based on the Council's short-term load model medium forecast and will be adjusted to include the expected efficiency savings from the Council's latest power plan.

## METHODOLOGY

The adequacy of the Northwest's power supply is assessed by computing the likelihood of a supply shortfall, five years into the future, using probabilistic simulation methods. This approach differs from historical static methods that simply tally expected regionally owned resource capability and expected regional demand. Probabilistic methods are commonly used around the country and the world as they offer a better assessment of adequacy than static measures of load/resource balance and of capacity planning margins.

The metric used to assess the adequacy of the Northwest's power supply is the loss-of-load probability (LOLP). The LOLP is measured by performing a chronological hourly

---

<sup>1</sup> Hydroelectric system flexibility in this context is energy derived from drafting reservoirs (for short periods of time) deeper than contractual drafting rights elevations during periods of stress. This "borrowed" energy is replaced as soon as possible and rarely carries over into the following month. This is a common practice in operations.

simulation of the power system's operation over many uncertain conditions<sup>2</sup>, including water supply, temperature (load variation), wind generation and resource forced outages.

The resulting simulated shortfalls (periods when resources fail to meet demand) are compared against the aggregate peaking and energy capability of standby resources. Standby resources are generating resources and demand-side management actions, contractually available to Northwest utilities, which can be accessed quickly, if needed, during periods of stress. These resources are intended to be used infrequently.

Shortfalls that exceed the aggregate capability of standby resources are considered curtailment events.<sup>3</sup> The LOLP is assessed by dividing the number of simulations with at least one curtailment event by the total number of simulations.

## THE STANDARD

The power supply is deemed adequate if its LOLP, five years into the future, is 5 percent or less. This means that the likelihood of at least one curtailment event occurring sometime during that year must be 5 percent or less.

The Council added a second level to the assessment, to indicate whether the power supply is close to becoming inadequate. The metric and associated threshold for this second-level test will be defined by the Forum and will likely include the probability of standby resource use. In that case, when the LOLP is less than 5 percent but the likelihood of using standby resources is greater than what utilities can tolerate, the power supply is considered to be approaching inadequacy.

The Council has adopted a color code to differentiate among three possible conditions for the power supply. When the LOLP is less than 5 percent and the second-level metric is below its threshold, the power supply is deemed adequate and is given a "green light" status.<sup>4</sup> When the LOLP is less than 5 percent but the second-level metric exceeds its threshold, the power supply is approaching inadequacy and a "yellow light" status is

---

<sup>2</sup> This type of simulation is often referred to as a Monte-Carlo analysis.

<sup>3</sup> It should be noted that these simulated curtailment events do not necessarily translate into real curtailments because utilities often have other, more extreme, actions that they can take. However, for assessing adequacy, the threshold is set at the capability of standby resources.

<sup>4</sup> A "green light" status should not be interpreted as meaning that the region has a cost effective and economic risk-averse power supply. An adequacy assessment does not equate to a resource planning strategy, as is developed in the Council's power plan.

assigned. When the LOLP is greater than 5 percent, the power supply is deemed inadequate and a “red light” status is assigned.

## IMPLEMENTATION PLAN

The adequacy standard adopted by the Council does not mandate compliance or imply any enforcement mechanisms. It does not apply to individual utilities because each utility faces different circumstances. It is intended to be an early warning should aggregate regional resource development fall short, for whatever reason. The Council believes that information in the assessment and the associated *State of the System* report will provide utility planners a wealth of useful information to aid them in developing their own integrated resource plans.

The Council will release its adequacy assessment and *State of the System* report annually. If the status is yellow, meaning that the power supply is closer to becoming inadequate, the Forum will be asked to review the data and analysis. If the status is red and conditions are more critical, the Forum will be asked to identify where potential shortfalls could occur. Details about the role of the Council and the Forum can be found in the implementation plan.<sup>5</sup>

## STATE OF THE SYSTEM REPORT

The *State of the System* report, which the Forum is developing, is intended to provide more detail about the status of the power supply. It should be viewed as a complementary report to the Bonneville Power Administration’s *White Book* and to the Pacific Northwest Utilities Conference Committee’s *Northwest Regional Forecast*.

The report begins with the adequacy assessment and other commonly used adequacy metrics. These other metrics, while not a part of this standard, measure different aspects of the power supply’s adequacy and are often used in different parts of the country and the world. By providing these measures, the assessment can be interpreted more easily by other regions. Among other things, they provide information about the size and frequency of potential problems.

The report will provide analysis on annual, monthly and hourly results. It will break down the LOLP assessment into monthly components so planners can identify periods of the year when problems are more likely to occur. It will provide a monthly assessment of

---

<sup>5</sup> The current implementation plan can be found at <http://www.nwcouncil.org/library/2008/2008-07.pdf>.

how often and how much of the market supply is used. Statistics for simulated shortfall events will be presented along with conditions under which they occur. Hourly probability distributions will be provided for important parameters like the use of market

q:\tm\council mtgs\2011\dec11\c01c\_new adeq std.docx

# A New Adequacy Standard for the Pacific Northwest



Northwest Power and Conservation Council  
December 6, 2011  
Portland, Oregon

## Outline

- Ø Why change the adequacy standard?
- Ø How was it changed?
- Ø The new adequacy standard
- Ø Interpretation of the standard
- Ø *State of the System* report
- Ø **If needed, a sample report**

## Why change the Adequacy Standard?

1. **Static metrics were confusing**  
Translating the probabilistic LOLP measure into static load/resource balance and planning margins yielded different results from NRF and White Book values – had to always explain why
2. **Not all months were examined**  
Only examined winter and summer  
Did not check for energy problems in summer
3. **Screening method too general**  
Used to adjust for non-modeled emergency resources  
Used general energy and capacity capabilities assumptions
4. **Not enough information about potential shortfalls**  
No indication of size, frequency and duration of problems
5. **Not enough information about market and non-firm resources**  
No indication of how often or how much they were used

December 6, 2011

Council Meeting



## Changes to the Adequacy Standard

1. **Static metrics were confusing**  
Eliminate the translation of LOLP into static metrics
2. **Not all months were examined**  
Examine every hour of every month for both energy and capacity shortfalls
3. **Screening method too general**  
Identify all standby emergency resources  
Use their aggregate energy and peaking capabilities as a screen
4. **Not enough information about potential shortfalls**  
Create a *State of the System* report that includes detailed information about potential shortfalls, including conditions under which they occur
5. **Not enough information about market and non-firm resources**  
Add to the *State of the System* report information about how often and how much market and non-firm resources are used

December 6, 2011

Council Meeting



## The New Adequacy Standard

(Revisions in Yellow)

- Ø Use a chronological hourly simulation
- Ø Run many games with different values for future unknowns
- Ø Future unknowns include:
  - § Water supply
  - § Temperature (load) variation
  - § Wind generation
  - § Forced outages

December 7, 2011

OSU GENESYS Briefing



## The New Adequacy Standard

- Ø Include some amount of market supply and non-firm hydro generation (to be set by the Forum)
- Ø Identify standby resources that are not intended to be used often but could be used during emergencies
- Ø Use aggregate capability of standby resources to screen events

December 7, 2011

OSU GENESYS Briefing



## The New Adequacy Standard

- ∅ Simulate the operation over every hour of every month
- ∅ Any game in which simulated shortfalls exceed the capabilities of standby resources at least once is a "bad" game
- ∅ LOLP = number of bad games divided by the total number of games
- ∅ The LOLP threshold is set to 5%

December 7, 2011

OSU GENESYS Briefing



## The New Adequacy Standard

- ∅ Use only one LOLP value
- ∅ No translation into static metrics
- ∅ Keep the "green," "yellow" and "red" alert system
  - § Red indicates an LOLP greater than 5%
  - § "Yellow" delineation determined by the Forum
- ∅ Provide a *State of the System* report that includes more useful information for regional planners

December 6, 2011

Council Meeting





## Interpretation of the Standard

- ∅ The likelihood of a future year having at least one unwanted event must be 5% or less for the power supply to be adequate.
- ∅ Intended to be a “smoke alarm” to indicate when supply falls dangerously short
- ∅ Does not take economic factors into consideration, thus will not necessarily reflect a “cost effective” power supply
- ∅ Not intended to be a resource needs assessment but could be used to support one

December 6, 2011

Council Meeting



## State of the System Report

- ∅ Other commonly used adequacy metrics
- ∅ How often and how much market and standby resources are used
- ∅ Monthly breakdown of potential shortfalls
- ∅ Frequency, duration and magnitude
- ∅ Conditions when events occur

December 6, 2011

Council Meeting



## Additional Slides if Needed

December 6, 2011

Council Meeting



## Adequacy metrics and values

Adequacy Metrics	
Metric	Description
LOLP	Loss of load probability = number of games with a problem divided by the total number of games
DR and SR	Demand response and standby resources that are contractually available = measure of
CVaR (energy)	Conditional value at risk = average annual curtailment for 5% worst games
CVaR (peak)	Conditional value at risk = average single-hour curtailment for worst 5% of games
EUE	Expected unserved energy = total curtailment divided by the total number of games
LOLE	Loss of load expectation = total number of hours of curtailment divided by total number of games

December 6, 2011

Council Meeting



## Adequacy metrics and values

Adequacy Metrics		
Metric	Value	Units
LOLP	6.7	Percent
Use of DR and SR	8.6	Percent
CVaR (energy)	67,618	MW-hours
CVaR (peak)	2,277	MW
EUE	3,399	MW-hours
LOLE	3.3	Hours/year

**For Illustration Only**

December 6, 2011

Council Meeting



## For Illustration Only Curtailment statistics

Expected Number of Events <sup>1</sup>	0.23 per year
Average Event Duration	14 Hours
Average Event Magnitude	14569 MW-hrs
Average Event Peak Shortfall	1098 MW
Expected Number of Shortfall Hours per year	3.3 per year
Percent of Games With an Event	8.6 percent

<sup>1</sup>An event is defined as a contiguous set of hours of shortfall.

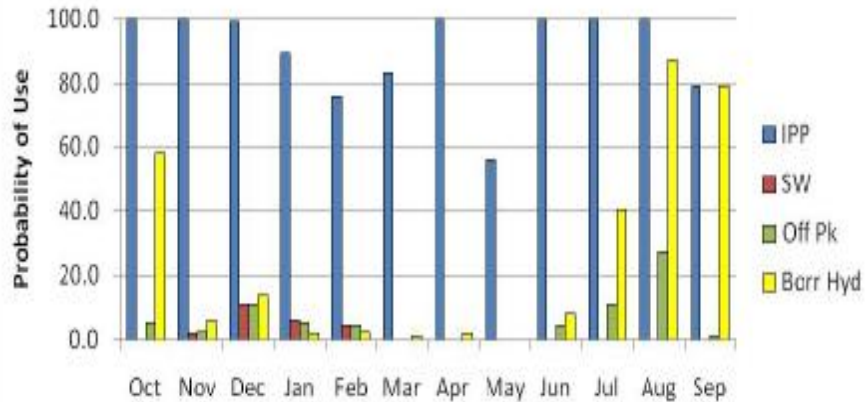
December 6, 2011

Council Meeting



## Market resources: % of time used

IPP = in-region market, SW = on peak out-of-region market  
 OFF PK = off peak out-of-region market, BORR HYD = hydro flexibility



For Illustration Only

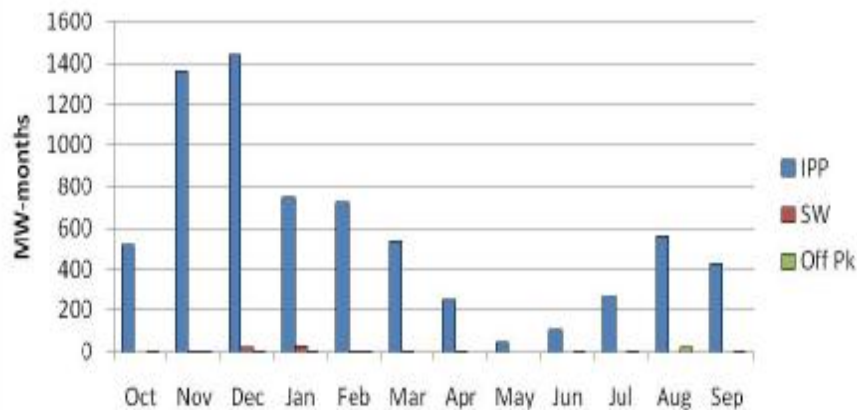
December 6, 2011

Council Meeting



## Non-firm resources: amount dispatched

Average Dispatch of Non-firm Resources



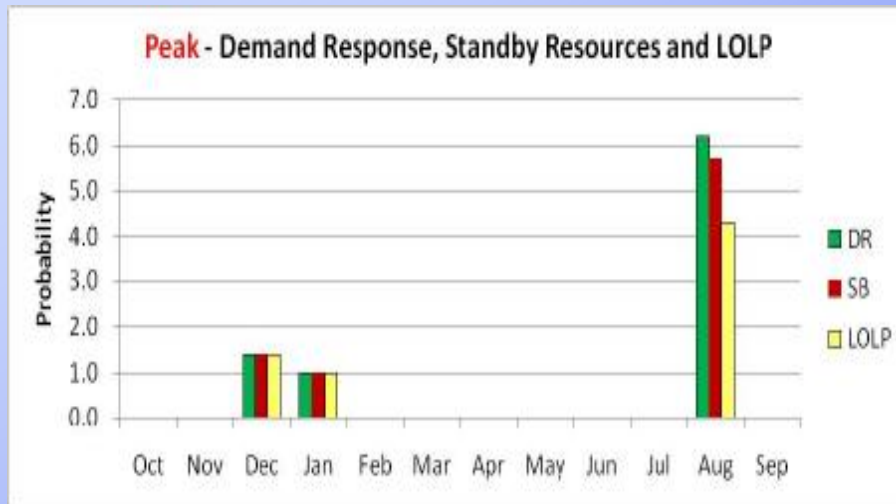
For Illustration Only

December 6, 2011

Council Meeting



## Monthly LOLP, use of SB and DR



**For Illustration Only**

December 6, 2011

Council Meeting

